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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKEUP EXAMINATIONS, MAY 2018

SUBJECT: APPLICATIONS OF DSP [ELE 4014]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: MAY 10, 2018** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. What is a point spread function in the digital imaging domain? Find its Fourier transform. ***(03)***

1B. State and prove Parseval's identity property of 2D discrete space Fourier transforms. ***(04)***

1C. What are multiplicatively separable functions? Is Fourier transform of a separable function is separable? Prove or disprove it. ***(03)***

2A. What are Eigen functions of 2D discrete space LSI systems? Prove it. ***(02)***

2B. State and explain Nyquist sampling theorem applicable to 2D signals. ***(04)***

Write relevant expressions for 2D sampling and its effect in the frequency domain.

2C. Filter the following (4×4) image using a (3×3) neighborhood averaging by assuming mirror boundary conditions on the boundary. ***(04)***

1	2	3
4	2	5
1	2	6

3A. What is histogram of an image? What do you achieve by histogram equalization? ***(02)***

3B. Analyze a (3×3) mean filter in the frequency domain and prove that it behaves like a low pass filter. ***(04)***

3C. (i) Explain the block diagram model for image degradation/restoration. ***(04)***

(ii) Write short notes on noise models.

4A. An (8×8) image $f[x, y]$ has gray levels given by the following equation: ***(04)***

$$f[x, y] = |x - y|; \qquad x, y = 0, 1, 2, 3, 4, 5, 6, 7.$$

Find the output image obtained by applying a (3×3) median filter on the image $f[x, y]$; ignore the border pixels.

4B. Write short notes on Butterworth high pass filter. ***(02)***

4C. Derive a (3×3) Laplacian of Gaussian kernel for edge detection by second order derivative method. Mention its drawbacks. ***(04)***

5A. Explain the following morphological operations: ***(03)***

(i) Opening (ii) Closing

5B. Write short notes on (i) Canny edge detection, (ii) Hit-or-miss transform ***(03)***

5C. Derive expressions for 1D-DCT using DFTs. Use the same to write expression for 2D-DCT. ***(04)***